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ORIGINAL ARTICLE

1470-nm Radial fiber-assisted liposuction for body contouring and facial fat grafting

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Abstract

Background: Laser-assisted liposuction using 1470-nm radial fiber emits light energy preferentially absorbed by water, yielding a rapid and localized contouring and tightening effect, with minimal scarring. When collected under appropriate conditions, extracted fat samples can be exploited as autologous filling material in liposculpturing procedures.

Objectives: To assess the 6-month contouring efficacy of 1470 radial fiber-assisted liposuction and the volumetric enhancement effect of the harvested tissue in facial fat grafting.

Methods: Twenty subjects underwent liposuction (BeautiFill, Alma Lasers, Inc.) of lower abdominal or outer thigh fat. In seven subjects, harvested samples were grafted into facial regions. Treatment safety, body weight, blinded evaluator-assessed aesthetic improvements, and subject-rated satisfaction were monitored for 6 months. Abdominal and facial fat thickness were assessed by magnetic resonance imaging ($n = 5$) within 3 months of treatment.

Results: One-month posttreatment, most subjects ranked improvements good/excellent (88%) and skin tightening satisfactory/very satisfactory (92%), with >70% of subjects providing similar scores 6-month posttreatment. Blinded evaluators noted improved/very much improved aesthetic appearance (87%). Harvested tissue injected as a facial filler (21.0 ± 5.2 ml) led to a 0.63 ± 0.12 mm increase in facial fat thickness, observed by MRI, within 3 months. Six months postfilling, the majority of subjects (83%) were satisfied with the outcome. All procedures were well-tolerated.

Conclusions: A single 1470 nm radial fiber-assisted abdominal and thigh liposuction session provided for effective and durable reduction of adipose tissue deposits, with appreciable skin tightening and aesthetic improvements. The gentle harvesting method yielded viable filler material, which was well-retained in facial regions for up to 6 months.

KEYWORDS
1470 nm, body contouring, fat grafting, liposuction, laser-assisted

1 | INTRODUCTION

Liposuction is currently the gold-standard procedure for minimal invasive body contouring and sculpting, and is the second most commonly performed elective plastic surgery procedure, accounting for 16.3% of the procedures performed in 2018 by plastic surgeons across the world.[1] Contemporary lipectomy techniques rely on a range of forces to disrupt and harvest subcutaneous adipose deposits, with the choice of technology often driven by patient characteristics and surgeon preference. For example, ultrasound-assisted liposuction (UAL) technology has been shown to enable deep and superficial fat emulsification, providing for improved skin retraction and overall appearance, without damaging surrounding vasculature and tissue.[2,3] Yet, the technique is time-consuming, due to the separate emulsification and skin tightening steps, and involves a steep learning curve.[4,5] In addition, complications related to this procedure included hyperpigmentation, seromas, nodular fibroses, and burns.[6] Similarly, water-assisted liposuction emits thin, fan-shaped jets of tumescent solution, which loosens fat cells, with minimal collateral damage to surrounding soft tissue. Cannula dimensions and the sheer stress applied provide for adjustment of the depth and aggressiveness of the process, which is generally considered gentle, but largely lacking in subsequent skin contraction.[7-9]

Laser-assisted liposuction (LAL), founded on localized thermal and micromechanical lipolysis of targeted tissues, affords removal of large volumes of fat deposits from both superficial and deep layers.[10] Its selective photothermolytic effect is mediated by subcutaneous chromophores receptive to specific laser wavelengths, which subsequently dictate the penetration depth and scatter profile, with high-absorption lasers providing a localized effects, while low-absorption lasers elicit more diffuse responses.[11] The resulting thermal injury triggers a healing process involving localized neocollagen deposition and subsequent skin thickening and contraction over the region of the aspirated adipose tissue.[12,13] Moreover, when compared with traditional mechanical liposuction, the laser-based method liquefies connective tissue more evenly, and elicits thrombosis of blood vessels and closure of lymphatic channels, translating to more uniform results and minimal bruising and downtime.[14] The 1470 nm laser emits light energy preferentially absorbed by water but with less tissue penetration and scatter as compared with shorter wavelength lasers. As a result, it induces a rapid and localized contouring effect, with the lower thermal impact sufficient to induce tissue tightening, with minimal scarring.[15,16]

When collected under appropriate conditions, extracted fat samples can be exploited as autologous filling material in liposculpturing procedures,[10,17,18] avoiding the complications associated with allogenic fillers and implants. Autologous fat transplantation has become a popular filling material, particularly in the face and hands,[17-19] largely due to its circumvention of complications associated with allogenic fillers and implants, high and simple accessibility, cost-effectiveness and host compatibility.[20,21] However, it often suffers from limited longevity, hypothesized to be largely determined by the number of viable preadipocytes in the grafted material.[22] The 1470 nm LipoLife platform (Alma Lasers, BeautiFill by LipoLife™) employs a unique radial emitting laser fiber that has no contact with the tissue since it is located inside a closed blunt Mercedes cannula and results in a soft thermal effect. This renders it ideal for gentle fat tissue collection and consequently reducing the risk of burns and internal scarring.[17] Furthermore, it has been shown to harvest tissue with high relative ratios of viable adipocytes, with few contaminants, seemingly optimal for fat grafting procedures.[23]

The present multi-center, open-label, prospective study aimed to assess the safety and 6-month contouring efficacy of LipoLife 1470 nm radial fiber-assisted liposuction of abdominal and outer thigh fat regions, as well as the volumetric enhancement effect of the harvested tissue in autologous facial fat grafting.

2 | METHODS

2.1 | Subjects

Adult individuals ($n = 20$) with excessive lower abdominal or outer thigh fat interested in undergoing LAL, and with a BMI ≤35 and without signs of severe skin laxity, were recruited to this study. Smokers, pregnant women, individuals with an active infection in the treatment area or who had recently used anticoagulants or nonsteroidal noninflammatory drugs for >7 consecutive days, or with history of an autoimmune disorder, keloid scarring, immune system disease or connective, metabolic or atrophic skin disease, were not eligible to participate in the study.

2.2 | Study design

This study was multi-center, prospective, open-label, single-arm study. The study was approved by the ethics committee of each participating site; Sanctuary Medical Center IRB approval (Pro00028811) and Shamir (Assaf Harofeh) Medical Center Helsinki approval (0159–18-ASF). Procedures were performed at the Sanctuary Plastic Surgery (SPS, Florida, USA) or Shamir (Assaf Harofeh) Medical Center's plastic surgery department (AHMC, Israel), only after subjects provided their signed, informed consent (including photo consent). In several subjects ($n = 7$) liposuction was followed by facial fat grafting (at least 5 cc). At the USA site, subjects also underwent magnetic resonance imaging (MRI) within 3 months of the procedure to assess abdominal fat thickness and facial fat volume. A presurgery evaluation was performed on all subjects 1 week before the procedure. Frontal, back (when relevant), 45-degree, and 90-degree position photographs of the target area were captured.

Preoperative antibiotic was administered at the physician's discretion. Tumescent lidocaine (≤45 mg/kg) was locally administered 20–30 min prior to the procedure. Adipose tissue was then harvested using the LipoFlow suction and the LipoDiode 1470 (Alma Lasers, BeautiFill by LipoLife™) using continuous wave mode. Samples of harvested fat tissue were sent to an external laboratory

for cell viability assessment (Tel Aviv Sourasky Medical Center, Israel) using the Trypan blue exclusion-based fat cells assay as previously described.[24] For facial fat grafting, harvested adipose tissue was collected using fat grafting sterile kit (Alma Lasers, BeautiFill by LipoLife™) at least 5 cc harvested adipose tissue was injected into the target site, including cheeks, temples, and nasolabial regions, using standard equipment. One day of hospitalization was required at the AHMC site. At discharge, subjects were recommended to rest for 2 weeks, rinse the surgical area with water and soap and wear an abdominal/thigh compression garment for the following 4–6 weeks (at the AHMC site only).

Follow-up evaluations, which included assessment of adverse events, body weight measurement, and photography of the treated area, were performed 1, 3- and 6-months postsurgery. In addition, at these same visits, subjects were asked to rate improvement using a 5-point Likert's scale, with "1" indicating no improvement and "5" indicating "excellent improvement." Subject overall satisfaction and satisfaction with skin tightening were rated on a 5-point scale, where "1" indicated "very dissatisfied" and "5" indicated "very satisfied." Subjects were also asked to rate their likelihood to recommend the treatment to friends and family on a scale ranging from "1 – extremely unlikely" to "5 – extremely likely." Subjects who had undergone a pretreatment MRI assessment were referred for a repeat assessment at the 3-month follow-up visit.

A panel of three blinded plastic surgeons were presented with a set of photos which they were asked to label as "before" or "after" and to grade using the 5-point global aesthetic improvement scale (GAIS), where "1" indicates optimal cosmetic results and "5" indicates worsened appearance as compared with baseline.

2.3 | Statistical analyses

Statistical analysis was performed using MedCalc statistical software. Data are presented as mean ±standard error of the mean (SEM). Paired student's t-test was used to calculate p values; a p-value <0.05 was considered statistically significant.

3 | RESULTS

In total, 20 subjects were enrolled in the study, all but two of whom were female (Table 1). Average participant age was 44.3 ± 2.3 years and weight and BMI were 78.0 ± 3.1 kg and 28.5 ± 0.7 kg/m^2, respectively (Table 1). All subjects were non-smokers and of overall good health. Liposuction procedures were performed in the lower abdomen and thigh (n = 5), lower abdomen only (n = 6) or outer thigh only (n = 9), aspirating a mean volume of 2.2 ± 0.2 L fat tissue. The procedures were well-tolerated, with procedure-related expected side effects limited to one mild case of liquid colonization in the treated left thigh, which was resolved by liquid suction using a syringe. The average cell viability counts were found to be extremely high (97 ± 0.01% per 1 ml lipoaspirate (n = 7)).

In 92% of cases, before and after body contouring photos were correctly classified by the three expert blinded surgeons (Figure 1). In 87% of the 25 treated areas, posttreatment appearance was ranked, by the blinded surgeons as improved to very much improved, at 1-month posttreatment, with scores remaining stable over the 6-month follow-up period (Table 2). The vast majority of subjects (88%) ranked improvements in the appearance of the treated site and their satisfaction levels, as good/excellent and satisfied/very satisfied respectively, at 1-month posttreatment (Table 3). The trend of high improvement and satisfaction scores was stable over the 6-month follow-up period. One month after the procedure, the skin tightening effect was rated satisfactory to very satisfactory by 92% of subjects, feedback that remained similar over the subsequent 5 months in 72% of cases. Four weeks after the procedure, all subjects claimed they were very or extremely likely to recommend the liposuction procedure to family and friends, feedback which remained consistent in 84% of the participants by the end of the study. MRI assessments performed on five subjects after 3 months demonstrated a 1 ± 0.3 cm (n = 5, p < 0.05. data not shown) reduction in abdominal thickness with no reduction in body weight (Figure 2). By the end of the 6 months follow-up period all subject body weight had dropped by 2.2 ± 0.5 kg.

In seven cases, harvested fat was immediately injected as a facial filler, at volumes averaging 21.0 ± 5.2 ml per subject (Figure 3). Posttreatment MRI evaluation of facial fat grafting areas identified a statistically significant increase in fat thickness (0.63 ± 0.12 mm) within 3 months of treatment, indicating sustained fat viability following implantation (Figures 4, 5). Physician-evaluated facial grafting outcomes at 1 month were rated satisfactory in 76% of the cases and declined, although not statistically significant, over the 6-month follow-up period. The majority of subjects (83%) scored their improvement level and satisfaction from the procedure as good/excellent and satisfied/very satisfied, respectively, at 6-months posttreatment (Table 4). All subjects reported that they would be extremely likely to recommend the liposuction procedure to family and friends, feedback which remained consistent throughout the follow-up period.

4 | DISCUSSION

Advances in LAL are continuously improving procedural safety and long-term outcomes. Particularly, introduction of the 1470 nm into the aesthetic surgeon toolbox has enabled gentle and effective localized extraction of excess fat deposits, of ideal quality for subsequent grafting applications. In the current study,1470 nm radial fiber-assisted liposuction of abdominal and thigh regions yielded discernible improvements, which were well sustained over the 6-month follow-up period. Subject satisfaction with the procedure and its skin tightening effect was consistently high throughout the study. Further, the liposuctioned adipose tissue samples sent for analysis, contained a high percentage of viable preadipocytes, which would account for the enhanced fat thickness over the 3 months following their implantation into facial regions. In turn, subject satisfaction

TABLE 1 Patients' demographics, baseline characteristics and procedure details

Subject Number	Site	Age	Weight (Kg)	BMI	Gender	Liposuction area	Energy (KJ)	Lipoaspirate volume (L)	Facial Fat Grafting volume injected (ml)	Fat vitality assessment amount of fat (ml)
1	Israel	43	61.0	22.7	F	Thighs	18.97	1.31	NA	NA
2	Israel	44	72.5	29.2	F	Abdominal& Thighs	27.58	2.45	NA	87
3	Israel	22	99.0	31.0	M	Abdominal	31.44	1.90	NA	70
4	Israel	55	85.2	30.5	F	Abdominal	21.31	2.05	NA	97.5
5	Israel	47	66.5	26.8	F	Abdominal	30	2.50	NA	NA
6	Israel	47	93.8	35.3	F	Thighs	51.63	3.62	NA	120
7	Israel	45	73.0	25.9	F	Thighs	34	1.87	4	100
8	Israel	37	63.5	24.0	F	Thighs	25	2.50	NA	110
9	Israel	29	72.0	26.8	F	Thighs	17.85	2.40	NA	NA
10	Israel	53	71.8	28.4	F	Thighs	12.24	2.20	NA	300
11	Israel	40	86.1	28.1	F	Abdominal	34.17	3.00	NA	NA
12	Israel	53	83.8	33.3	F	Thighs	25.7	3.06	6	NA
13	Israel	43	88.0	28.7	F	Thighs	15	3.10	NA	NA
14	Israel	39	78.4	32.5	F	Thighs	13	2.05	NA	NA
15	Israel	46	73.0	27.5	F	Abdominal	15	2.40	NA	NA
1	USA	65	74.8	29.2	F	Abdominal& Thighs	15.81	3.00	41	NA
5	USA	45	73.5	27.0	F	Abdominal& Thighs	15	1.90	25	NA
6	USA	57	61.0	28.3	F	Abdominal& Thighs	10.19	1.20	34	NA
7	USA	48	67.1	24.4	F	Abdominal& Thighs	15.77	0.60	23	NA
8	USA	28	116.2	30.4	M	Abdominal	21	1.50	14	NA
Average±SEM		44.3 ± 2.3	78 ± 3.1	28.5 ± 0.7			22.5 ± 2.3	2.2 ± 0.2	21 ± 5.2	126.4

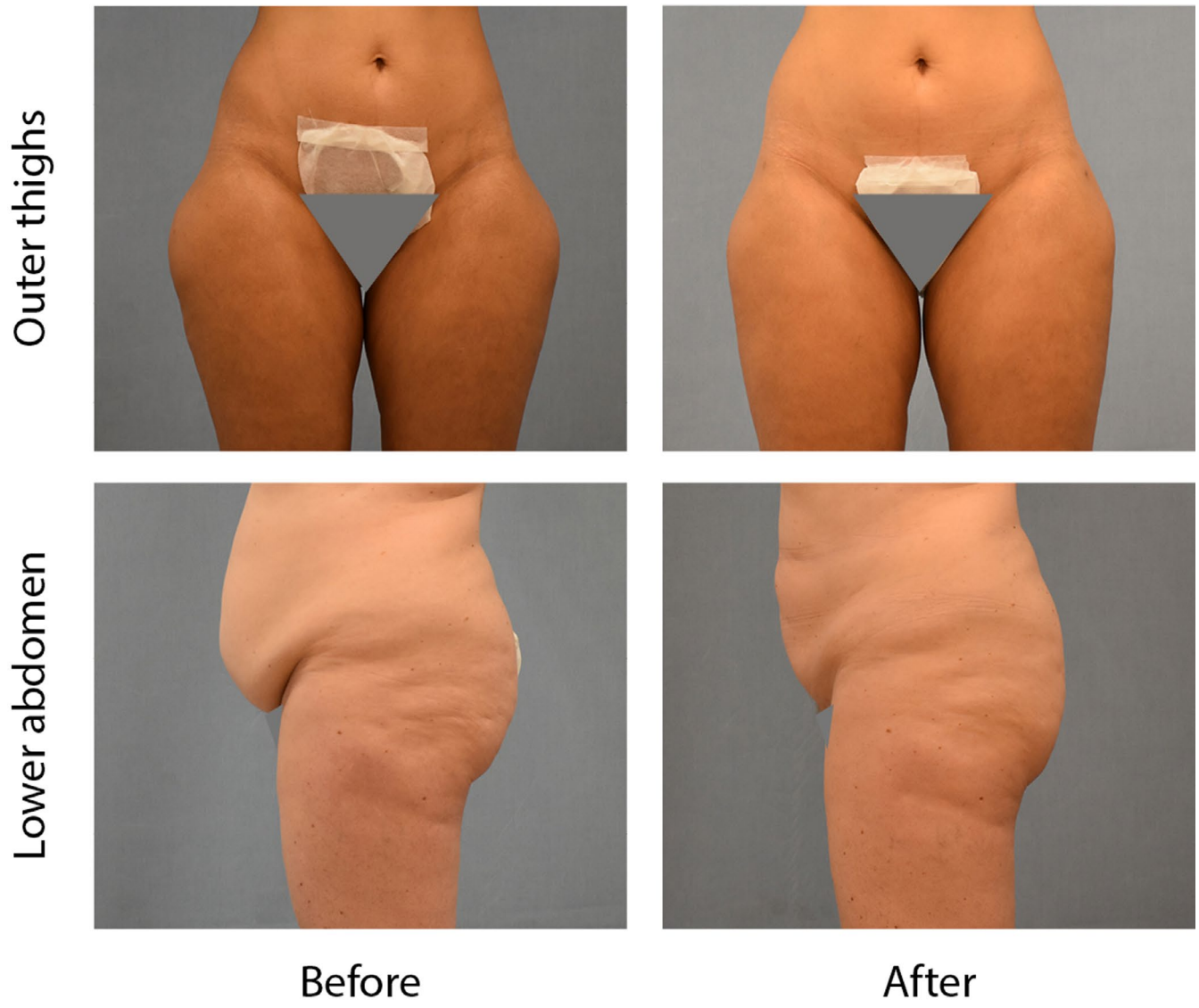

FIGURE 1 Clinical outcomes of 1470 nm radial fiber-assisted liposuction Representative photographs of outer thighs and lower abdominal regions before and 3 months after 1470 nm radial fiber-assisted liposuction. Up: Female – 43 years old, total aspirate of 1.31 L removed from the thighs. Below: Female – 55 years old, total aspirate of 2.05 L removed from the abdominal

TABLE 2 Blinded physician assessment of global aesthetic improvement ($n = 25$ treatment areas)

	Average (3 physicians)		
GAIS score of 1–3	1 M FU	3 M FU	6 M FU
No. of treatment areas	21.7	20.0	20.3
%	87	80	81

with grafting outcomes was unanimously high throughout the follow-up period. An added value came in the form of the average 2 kg weight loss measured in subjects by the end of the 6-month follow-up period, despite the relatively small volume of extracted fat, likely the result of improved psychosocial well-being and body image, motivating subjects to adhere to desirable lifestyle changes, including exercise regimens and careful diets.

The degree of photothermal effect on adipose tissue highly depends on the internal tissue temperature, with temperatures of 50–65°C destroying adipocytes and inducing tissue necrosis and scarring.[25] Due to the high water absorption coefficient of the 1470 nm illumination wavelength, relative gentle heating of the adipose tissue suffices to induce lipid release and reduce tissue viscosity,[26] enabling easy suction of large volumes of fatty deposit with no adipocyte rupture. The localized, controlled, and reversible thermal injury also imparts a hemostatic effect, achieved via small blood vessel coagulation, keeping blood loss and subsequent bruising at a minimum, overcoming two major limiting factors of conventional liposuction procedures.[11,27,28] At the same time, it coagulates fibrous tissue and stimulates a healing response, involving fibroblast recruitment and subsequent collagen neosynthesis, and remodeling.[11,28-30] A wavelength-dependent dermal response was demonstrated in several works, where low-energy lasers generally

TABLE 3 Subject Satisfaction – Percent with Likert Scale Score 4–5

	Subjects' assessment of Improvement			Subject Satisfaction			Satisfaction from skin Reaction (Tightening)		
	1 M FU	3 M FU	6 M FU	1 M FU	3 M FU	6 M FU	1 M FU	3 M FU	6 M FU
liposuction procedure % Patients with Likert scale 4–5 ($n = 25$ treatment areas)	88	88	84	88	84	88	92	84	72

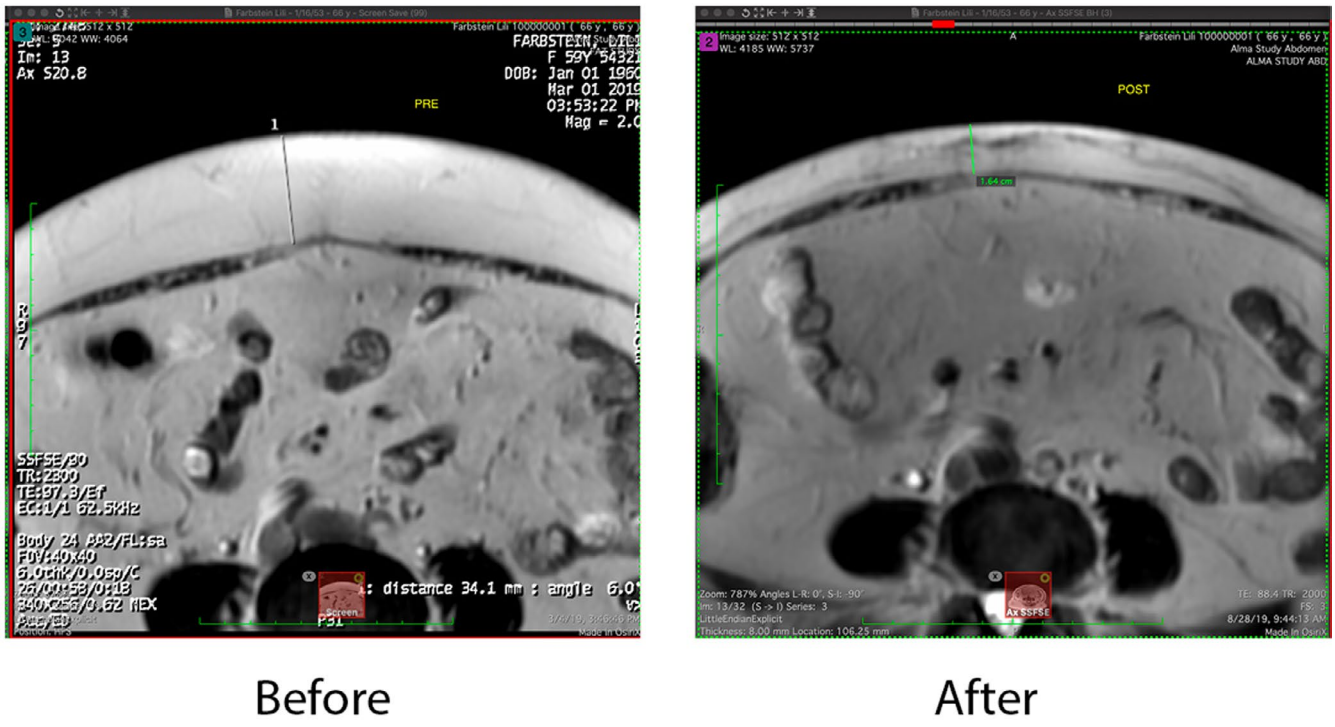

FIGURE 2 Abdominal fat thickness Representative MRI photographs of the lower abdominal region, before and 3 months after 1470 nm radial fiber-assisted liposuction showing reduction of −1.77 cm in abdominal fat thickness (the line indicates the abdominal fat thickness). Female – 65 years old.

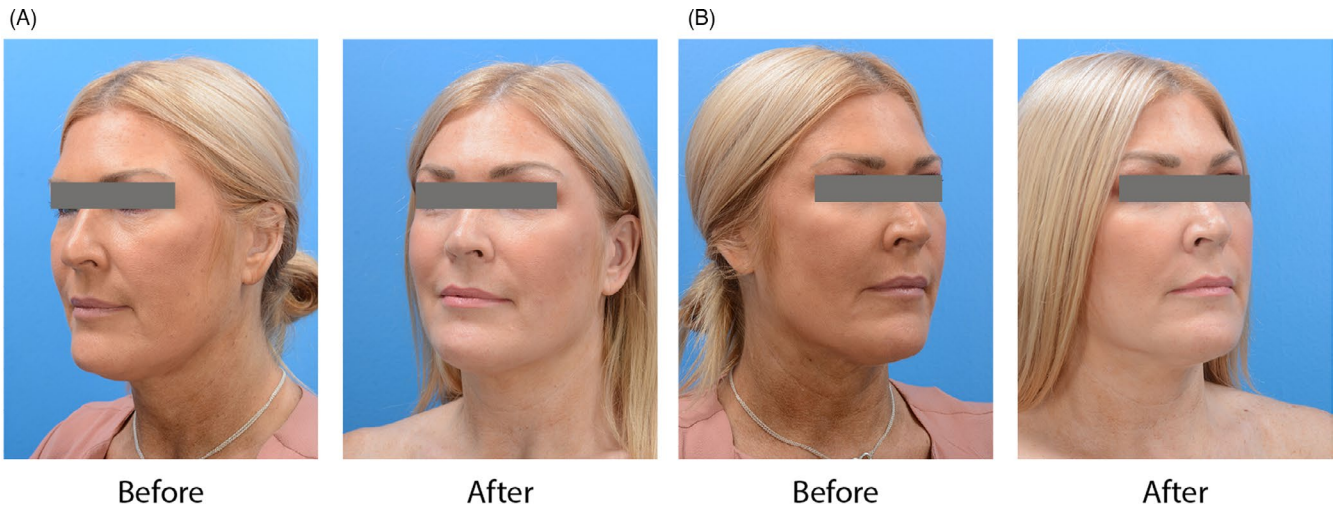

FIGURE 3 Clinical outcomes of facial fat grafting Representative photographs of subject before and 3 months after grafting in the cheeks, nasolabial folds and temples with adipose tissue harvested via 1470 nm radial fiber-assisted liposuction. A – 45 degrees to the Left, B – 45 degrees to the Right. Female – 48 years old.

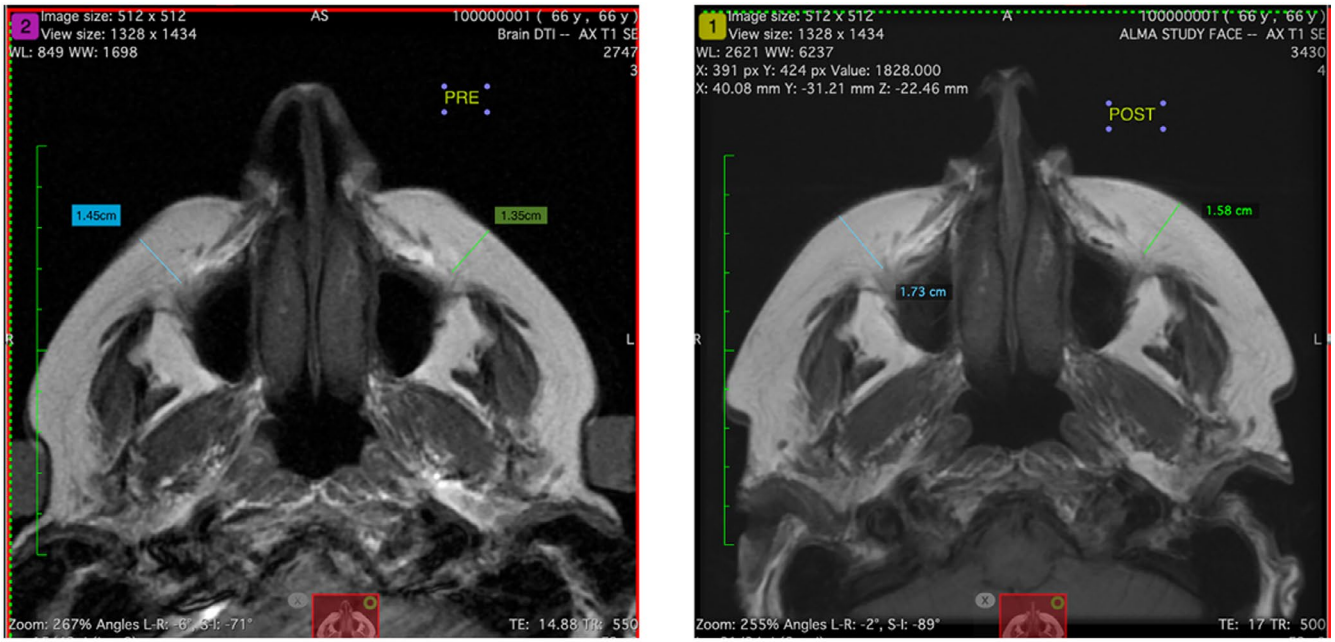

FIGURE 4 Facial Fat Grafting Representative MRI photographs of the facial region, before and 3 months after facial fat grafting procedure, showing increase in facial cheeks thickness: Rt+2.8 mm; Lt+2.3 mm (the line indicates the facial cheeks fat thickness). Female – 65 years old

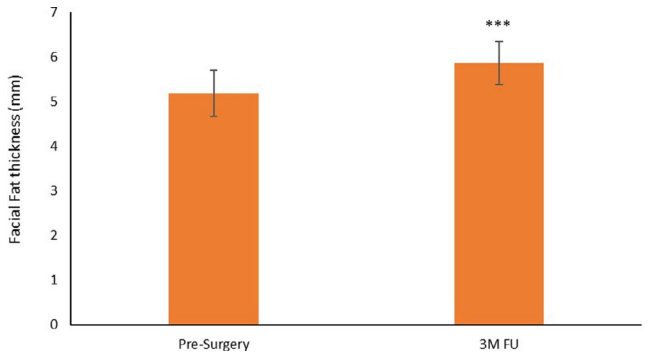

FIGURE 5 Facial fat volume The facial fat volume of 12 facial regions (5 subjects) grafted with adipose tissue harvested via 1470 nm radial fiber-assisted liposuction was measured before and 3 months after the procedure, by magnetic resonance imaging. Shown is the mean+SEM ($n = 12$ areas). ***$p < 0.001$

had a more extensive skin tightening effect as compared with higher energy lasers, possibly related to the end temperatures or to the targeted subdermal chromophores.[31] In contrast, non-thermal lipid harvesting techniques fail to stimulate adipocyte collagen deposition and to firm sagging skin and its underlying structures.[12,32,33] LAL in general, and 1470 nm LAL, in particular, achieves favorable and durable skin retraction outcomes, broadening treatment site criteria to include any region with even modest degrees of skin laxity.

In addition to the inherent benefits of the 1470 nm laser, the unique design features of the LipoLife platform further ensured its advantageous safety and tolerance profiles. More specifically, its radial configuration reduces emission intensity throughout the surgical field, further lowering risk of burns and internal scarring, while preserving adipocyte viability, and its rounded tip and small cannula size minimize tissue trauma. When applying the LipoLife 1470 nm radial diode laser for Teimourian grades I–II arm contouring in a single-session laser lipolysis procedure, Leclere and colleagues[15] reported on an average 4.7–5.5 cm decrease in arm circumference ($p < 0.01$), and an average skin pinch decrease of 2.1 cm and 2.9 cm among grade IIa and IIb patients, respectively. Patient-evaluated pain was minimal, and mean downtime was shorter than 1 day. The same group reported on a 26.6-degree reduction in cervicomental angle following LipoLife treatment in patients presenting Rohrich type IV aging neck.[34] When deployed to address gynecomastia, LipoLife liposuction brought to mean chest and areola diameter reductions of 11.93 cm and 1.80 cm, respectively, 6 months posttreatment ($p < 0.05$), without inducing any complications, skin burns, edema or areolar congestion.[16] Similarly, Nicoli et al. report on significant decreases in upper limb circumference in 10 patients with chronic advanced upper extremity lymphedema undergoing lymph node flap transfer in combination with 1470 nm LAL.[28]

Traditionally, liposuction techniques have been differentiated by safety, consistency of outcomes, operator effort, and downtime. Yet, today, the quality and viability of the extracted sample has become a highly relevant parameter as well. Indeed, extraction techniques have been shown to yield differential adipocyte viability, generally proving low when mechanical trauma and/or chemical reagents are

TABLE 4 Subject Satisfaction with Facial Fat Grafting – Percent with Likert Scale Score 4–5

	Subjects' assessment of Improvement (1–5)			Subject Satisfaction (1–5)			Satisfaction from skin Reaction (1–5)			Subject Personal Experience (1–5)		
	1 M FU	3 M FU	6 M FU	1 M FU	3 M FU	6 M FU	1 M FU	3 M FU	6 M FU	1 M FU	3 M FU	6 M FU
Facial Fat Grafting (% of patients) $n = 7$	86	71	83	100	86	83	100	86	83	100	100	100

involved.[35-37] Following an up to 17-year follow-up of the long-term results of facial injections of mechanically collected autologous fat material performed in 1720 patients, Dasiou-Plakida reported on an estimated 20–30% resorption within 4–8 weeks and 40–60% resorption within 12–24 months of implantation.[19] Others have reported on even higher resorption rates, leaving clinical outcomes highly unpredictable.[38,39] The gentle thermal effect of the 1470 nm laser has been correlated with homogenous extracts enriched with viable preadipocyte content and low fibrous tissue and blood content in the implanted fat material,[23,40] central determinants of resorption rates.[22,40] Indeed, when applied here in autologous fat transfer procedures for skin rejuvenation and volume enhancement, a durable filling effect was achieved.

The current study design was limited by the small sample size, the relatively short follow-up period, as well as the non-controlled analyses. Controlled, long-term studies monitoring the durability of response are still needed.

5 | CONCLUSION

A single 1470 nm radial fiber-assisted liposuction session for abdominal and thigh contouring, provided for gentle yet effective reductions in adipose tissue deposits, which proved durable for at least 6 months. The gentle thermal effect triggered clinically appreciable skin tightening, which translated an improved cosmetic appearance as reported by both physicians and subjects. Furthermore, the harvesting technique yielded a viable adipocyte-rich autologous facial filler material, which was well-retained in the implantation site.

ClinicalTrial.gov ID MCT03800563, https://clinicaltrials.gov/ct2/show/NCT03800563

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CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

AUTHORS' CONTRIBUTIONS

All authors' have read and approved the final manuscript. L.H., S.M., L.P., O.S.A. and J.N.P. performed the research. L.H. and J.N.P designed the research study. S.M. analyzed the data. L.P. wrote the paper.

ETHICAL STATEMENT

The study was approved by Shamir Medical Center Helsinki committee, Israel (0159–18-ASF, Approval date: 21 Aug 2018) and by ADVARRA IRB, USA (Pro00028811, Approval date: 17 Sep 2018). The study was registered on www.clinicaltrials.gov; NCT03800563.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

1. Isaps international survey on aesthetic/cosmetic procedures 2018 https://www.Isaps.Org/wp-content/uploads/2019/12/isaps-global-survey-results-2018-new.Pdf accessed on july 15, 2020
2. Hoyos A, Perez ME, Guarin DE, et al. A report of 736 high-definition lipoabdominoplasties performed in conjunction with circumferential vaser liposuction. *Plast Reconstr Surg*. 2018;142(3):662-675.
3. Chambers A. Severe gynaecomastia treatment with vaser liposuction and spring suspension sutures in modified webster mastectomy. *Adv Plast Reconstr Surg*. 2019;3(3):274-285.
4. Zukowski ML, Ash K. Ultrasound-assisted lipoplasty learning curve. *Aesthet Surg J*. 1998;18(2):104-110.
5. Hoyos AE, Millard JA. Vaser-assisted high-definition liposculpture. *Aesthet Surg J*. 2007;27(6):594-604.
6. Danilla S, Babaitis RA, Jara RP, et al. High-definition liposculpture: What are the complications and how to manage them? *Aesthetic Plast Surg*. 2020;44(2):411-418.
7. Sasaki GH. Water-assisted liposuction for body contouring and lipoharvesting: Safety and efficacy in 41 consecutive patients. *Aesthet Surg J*. 2011;31(1):76-88.
8. Araco A, Gravante G, Araco F, et al. Comparison of power water–assisted and traditional liposuction: A prospective randomized trial of postoperative pain. *Aesthetic Plast Surg*. 2007;31(3):259-265.
9. Kaye KO, Kastner S, Paprottka FJ, et al. The liquid facelift: First hands-on experience with facial water jet-assisted liposuction as an additive technique for rhytidectomy - a case series of 25 patients. *J Plast Reconstr Aesthet Surg*. 2018;71(2):171-177.
10. Kim KH, Geronemus RG. Laser lipolysis using a novel 1,064 nm nd: Yag laser. *Dermatol Surg*. 2006;32(2):241-248. discussion 47.
11. Levi JR, Veerappan A, Chen B, et al. Histologic evaluation of laser lipolysis comparing continuous wave vs pulsed lasers in an in vivo pig model. *Arch Facial Plast Surg*. 2011;13(1):41-50.
12. Goldman A, Gotkin RH. Laser-assisted liposuction. *Clin Plast Surg*. 2009;36(2):241-253. vii; discussion 55–60.
13. Metelitsa AI, Alster TS. Fractionated laser skin resurfacing treatment complications: A review. *Dermatol Surg*. 2010;36(3):299-306.
14. Reynaud JP, Skibinski M, Wassmer B, et al. Lipolysis using a 980-nm diode laser: A retrospective analysis of 534 procedures. *Aesthetic Plast Surg*. 2009;33(1):28-36.
15. Leclere FM, Alcolea JM, Vogt P, et al. Laser-assisted lipolysis for arm contouring in teimourian grades i and ii: A prospective study of 45 patients. *Lasers Med Sci*. 2015;30(3):1053-1059.
16. Trelles MA, Mordon SR, Bonanad E, et al. Laser-assisted lipolysis in the treatment of gynecomastia: A prospective study in 28 patients. *Lasers Med Sci*. 2013;28(2):375-382.
17. Xie Y, Zheng DN, Li QF, et al. An integrated fat grafting technique for cosmetic facial contouring. *J Plast Reconstr Aesthet Surg*. 2010;63(2):270-276.
18. Charles-de-Sa L, Gontijo-de-Amorim NF, Maeda Takiya C, et al. Antiaging treatment of the facial skin by fat graft and adipose-derived stem cells. *Plast Reconstr Surg*. 2015;135(4):999-1009.
19. Dasiou-Plakida D. Fat injections for facial rejuvenation: 17 years experience in 1720 patients. *J Cosmet Dermatol*. 2003;2(3–4):119-125.
20. Banyard DA, Salibian AA, Widgerow AD, et al. Implications for human adipose-derived stem cells in plastic surgery. *J Cell Mol Med*. 2015;19(1):21-30.
21. Etzkorn JR, Divine JM, Lopez JJ, et al. Autologous fat transfer: Techniques, indications, and future investigation. *Cosmetic Dermatology*. 2011;24:470-476.
22. Peer LA. The neglected "free fat graft", its behavior and clinical use. *The American Journal of Surgery*. 1956;92(1):40-47.
23. Levenberg A, Scheinowitz M, Sharabani-Yosef O. Higher cell viability and enhanced sample quality following laser-assisted liposuction versus mechanical liposuction. *J Cosm Derm Sci App*. 2015;5:238-245.
24. Strober W. Trypan Blue Exclusion Test of Cell Viability. *Curr Protoc Immunol* 2015;111:A3 B 1-A3 B 3.
25. Tagliolatto S, Medeiros VB, Leite OG. Laserlipolysis: Update and literature review. *Surg Cosmet Dermatol*. 2012;4(2):164-174.
26. Mordon SR, Wassmer B, Reynaud JP, et al. Mathematical modeling of laser lipolysis. *Biomed Eng Online*. 2008;7:10.
27. Dixit VV, Wagh MS. Unfavourable outcomes of liposuction and their management. *Indian J Plast Surg*. 2013;46(2):377-392.
28. Nicoli F, Constantinides J, Ciudad P, et al. Free lymph node flap transfer and laser-assisted liposuction: A combined technique for the treatment of moderate upper limb lymphedema. *Lasers Med Sci*. 2015;30(4):1377-1385.
29. Alam M, Hsu TS, Dover JS, et al. Nonablative laser and light treatments: Histology and tissue effects–a review. *Lasers Surg Med*. 2003;33(1):30-39.
30. Khan M H, Sink R K, Manstein D, et al. Intradermally focused infrared laser pulses: Thermal effects at defined tissue depths. *Lasers Surg Med*. 2005;36:270-280.
31. Reszko AE, Magro CM, Diktaban T, et al. Histological comparison of 1064 nm nd: Yag and 1320 nm nd: Yag laser lipolysis using an ex vivo model. *J Drugs Dermatol*. 2009;8(4):377-382.
32. Pereira-Netto D, Montano-Pedroso JC, Aidar ALES, et al. Laser-assisted liposuction (lal) versus traditional liposuction: Systematic review. *Aesthetic Plast Surg*. 2018;42(2):376-383.
33. Valizadeh N, Jalaly NY, Zarghampour M, et al. Evaluation of safety and efficacy of 980-nm diode laser-assisted lipolysis versus traditional liposuction for submental rejuvenation: A randomized clinical trial. *J Cosmet Laser Ther*. 2016;18(1):41-45.
34. Leclere FM, Vogt PM, Moreno-Moraga J, et al. Laser-assisted lipolysis for neck and submental remodeling in rohrich type iv patients: Fact or fiction? *J Cosmet Laser Ther*. 2015;17(1):31-36.
35. Duscher D, Maan ZN, Luan A, et al. Ultrasound-assisted liposuction provides a source for functional adipose-derived stromal cells. *Cytotherapy*. 2017;19(12):1491-1500.
36. Harats M, Millet E, Jaeger M, et al. Adipocytes viability after suction-assisted lipoplasty: Does the technique matter? *Aesthetic Plast Surg*. 2016;40(4):578-583.
37. Taha S, Saller MM, Haas E, et al. Adipose-derived stem/progenitor cells from lipoaspirates: A comparison between the lipivage200-5 liposuction system and the body-jet liposuction system. *J Plast Reconstr Aesthet Surg*. 2020;73(1):166-175.
38. Doornaert M, Colle J, De Maere E, et al. Autologous fat grafting: Latest insights. *Ann Med Surg*. 2019;37:47-53.
39. Ma L, Wen H, Jian X, et al. Cell-assisted lipotransfer in the clinical treatment of facial soft tissue deformity. *Plast Surg*. 2015;23(3):199-202.
40. Sommer B, Sattler G. Current concepts of fat graft survival: Histology of aspirated adipose tissue and review of the literature. *Dermatol Surg*. 2000;26(12):1159-1166.

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